



Organization(s): Lawrence Livermore National Laboratories

MTO **Composite
CAD**

Title: Lattice Boltzmann Simulation of Particle Laden Flows in Microfluidic Systems

Duration of Effort: July 2000 - July 2002

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Objective

The objective of the work proposed here is to develop predictive simulation tools to study the dynamic behavior of particles and macromolecules in microfluidic subsystems. Here the focus is on the particulate phase in a suspending fluid. The simulation capability will enable the study of suspensions and suspension properties when subject to pressure driven flow (Newtonian and simple non-Newtonian fluids), phoretic transport mechanisms, intermolecular and surface forces, and external field effects.

Technical Approach

- Develop new and enhanced lattice Boltzmann simulation capabilities.
- Develop relevant theory for Physics Modules.
- Develop interface to incorporate Physics Modules into the LB capability.

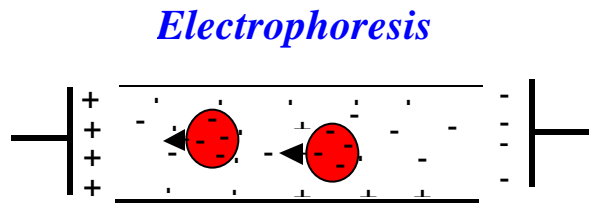
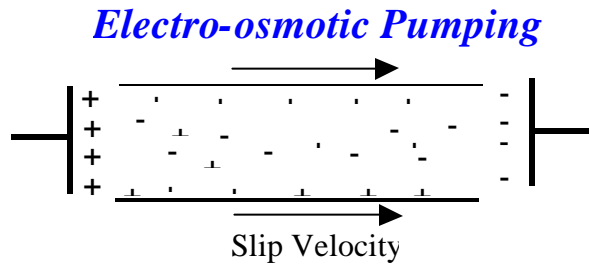
Major Challenges

- The major challenges involve the proper determination and accounting of the important length and time scales,
- the proper conversion between physical space and lattice space, and
- the appropriate handling of interactions that occur at the sub-lattice spacing length scale.

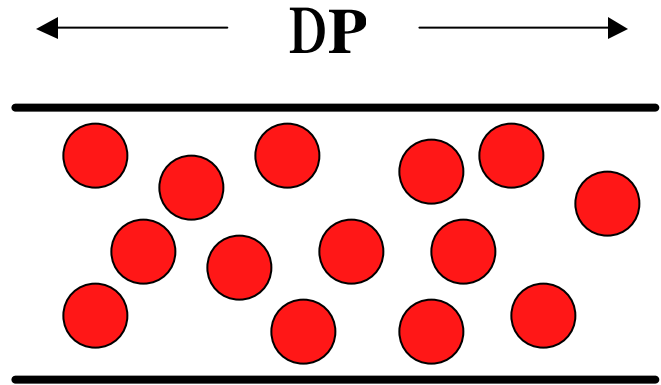
6th Month Milestones

- Develop and Validate Force Filter.
 - Set-up and initiate characterization of suspension behavior in micro-channel flows (Newtonian fluids).
 - Demonstration of 2D EO flow and 2D Electrophoretic motion.
 - Framework to extend Phoretic Transport Module to 3D.
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Phoretic Transport Mechanisms (Electrokinetic Phenomena)



Suspension Properties



- Velocity Profile
- Concentration Profile
- Particle Trajectories
- Bulk Resistance to Flow (viscosity)